FORM PTO-1390 (REV. 11-2000) U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

ATTORNEY 'S DOCKET NUMBER: 1981/2

U.S. APPLICATION NO. (If known, see 37 CFR 1.5): 09/857852

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/GB99/04170	10/December/1999	12/December/1998

TITLE OF INVENTION: IMPROVEMENTS IN OR RELATING TO PIPES

APPLICANT(S) FOR DO/EO/US: BOATMAN, Peter James

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. [XX] This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. [ ] This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. [XX] This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (21) indicated below.
4. [XX] The US has been elected by the expiration of 19 months from the priority date (Article 31).
5. [XX] A copy of the International Application as filed (35 U.S.C. 371(c)(2))
   a. [ ] is attached hereto (required only if not communicated by the International Bureau).
   b. [XX] has been communicated by the International Bureau.
   c. [ ] is not required, as the application was filed in the United States Receiving Office (RO/US).
6. [ ] An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).
   a. [ ] is attached hereto.
   b. [ ] has been previously submitted under 35 U.S.C. 154(d)(4).
7. [XX] Amendments to the claims of the International Aplication under PCT Article 19 (35 U.S.C. 371(c)(3))
   a. [ ] are attached hereto (required only if not communicated by the International Bureau).
   b. [ ] have been communicated by the International Bureau.
   c. [ ] have not been made; however, the time limit for making such amendments has NOT expired.
   d. [XX] have not been made and will not be made.
8. [ ] An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371 (c)(3)).
9. [XX] An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)). (UNSIGNED)
10. [ ] An English lanugage translation of the annexes of the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11 to 20 below concern document(s) or information included:

11. [ ] An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. [ ] An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. [XX] A FIRST preliminary amendment.
14. [ ] A SECOND or SUBSEQUENT preliminary amendment.
15. [ ] A substitute specification.
16. [ ] A change of power of attorney and/or address letter.
17. [ ] A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821 - 1.825.
18. [ ] A second copy of the published international application under 35 U.S.C. 154(d)(4).
19. [ ] A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).
20. [XX] Other items or information:
    Power of Attorney (UNSIGNED)
    Application Data Sheet
    Copy of International Search Report prepared by the European PatentOffice

531 Rec'd PCT/PTO 11 JUN 2001

U.S. APPLICATION NO. (If known, see 37 CFR 1.5) 09/857852	INTERNATIONAL APPLICATION NO.	ATTORNEY'S DOCKET NUMBER

21. [X] The following fees are submitted:

BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)):

		CALCULATIONS PTO USE ONLY
Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO	$1000.00	
International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO	$860.00	
International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO	$710.00	
International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4)	$690.00	
International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4)	$100.00	
ENTER APPROPRIATE BASIC FEE AMOUNT =		$ 860.00
Surcharge of **$130.00** for furnishing the oath or declaration later than [ ] 20 [XX] 30 months from the earliest claimed priority date (37 CFR 1.492(e)).		$ 130.00

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE	
Total claims	19 - 20 =	0	x $18.00	$ 0.00
Independent claims	3 - 3 =	0	x $80.00	$ 0.00
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ $270.00	$ 0.00
TOTAL OF ABOVE CALCULATIONS =				$ 990.00
[XX] Applicant claims small entity status. See 37 CFR 1.27. The fees indicated above are reduced by 1/2.			+	$ 495.00
SUBTOTAL =				$ 495.00
Processing fee of **$130.00** for furnishing the English translation later than [ ] 20 [ ] 30 months from the earliest claimed priority date (37 CFR 1.492(f)).				$ 0.00
TOTAL NATIONAL FEE =				$ 495.00
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). **$40.00** per property +				$ 0.00
TOTAL FEES ENCLOSED =				$ 495.00
			Amount to be refunded:	$
			charged:	$

a. [X] A check in the amount of $ 495.00 to cover the above fees is enclosed.

b. [ ] Please charge my Deposit Account No. _____ in the amount of $ _____ to cover the above fees. A duplicate copy of this sheet is enclosed.

c. [X] The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 01-0265. A duplicate copy of this sheet is enclosed.

d. [ ] Fees are to be charged to a credit card. **WARNING:** Information on this form may become public. **Credit card information should not be included on this form.** Provide credit card information and authorization on PTO-2038.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137 (a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

Jeffrey J. Schwartz
ADAMS, SCHWARTZ & EVANS, P.A.
2180 Two First Union Center
Charlotte, NC 28282 USA
Tel: 704/375-9249
Fax: 704/375-0729

SIGNATURE

Jeffrey J. Schwartz
NAME

37,532 6/11/01
REGISTRATION NUMBER

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANT: BOATMAN, Peter James

INTERNATIONAL APPLICATION NO.: PCT/GB99/04170

INTERNATIONAL FILING DATE: December 10, 1999

FOR: IMPROVEMENTS IN OR RELATING TO PIPES

BOX PCT
Assistant Commissioner for Patents
Washington, D.C. 20231

PRELIMINARY AMENDMENT

Sir:

After the assignment of a serial number and prior to the initial examination of the above-identified application, please enter the attached abstract and make the following amendments:

IN THE SPECIFICATION:

Amend the specification by inserting before the first line on page 1:

--This application is a national stage application, according to Chapter II of the Patent Cooperation Treaty. This application claims the priority date of December 12, 1998 for United Kingdom Patent Application No. 9827308.9.--

IN THE CLAIMS:

Please amend the claims as follows:

3. (Amended) A pipe according to claim 1 where the outer layers are in the form of tubes.

6. (Amended) A method according to claim 4, wherein the core layer is formed of a plastic concrete and is introduced in a flowable state between the preformed material layers to be moulded therein.

7. (Amended) A method according to claim 4, wherein the preformed material layers are formed and are retained in their moulds to provide the formwork for moulding of the core layer.

9. (Amended) A method according to claim 4 wherein the plastic concrete is adjusted so as to commence curing within a short time of being introduced between the preformed layers, whereby lower layers of the plastic concrete cure when further layers of the plastic concrete are introduced.

10. (Amended) A method according to claim 4 wherein the material layers are formed from synthetic resin.

11. (Amended) A method according to claim 4 wherein the core layer comprises a thermosetting resin or a thermoplastic resin.

14. (Amended) A method according to claim 10 wherein the core layer further includes a reinforcement.

17. (Amended) A method according to claim 13 wherein the core layer includes further reinforcement.

Please cancel claims 20 and 21.

REMARKS

Pursuant to 37 C.F.R. §1.121(c)(ii), a marked-up copy of the amended claims is included with this Preliminary Amendment and labeled as "Exhibit A". It is believed that this application is now in condition for allowance. Such action at an early date is respectfully requested.

Respectfully submitted,

Jeffrey J. Schwartz
Attorney for Applicant
Reg. No. 37,532

Jeffrey J. Schwartz
ADAMS, SCHWARTZ & EVANS, P.A.
2180 TWO FIRST UNION CENTER
CHARLOTTE, N.C. 28282
TEL: (704) 375-9249
FAX: (704) 375-0729
Email: jjs@adamspat.com
Our File No. 1981/2

EXHIBIT A

AMENDED CLAIMS - MARKED-UP COPY
(U.S. National Phase of International Application No. PCT/GB99/04170)

3. (Amended) A pipe according to claim 1 [or 2] where the outer layers are in the form of tubes.

6. (Amended) A method according to claim 4 [or 5], wherein the core layer is formed of a plastic concrete and is introduced in a flowable state between the preformed material layers to be moulded therein.

7. (Amended) A method according to [any of claims 4, 5 or 6] claim 4, wherein the preformed material layers are formed and are retained in their moulds to [provided] provide the formwork for moulding of the core layer.

9. (Amended) A method according to [any of claims 4 to 8] claim 4 wherein the plastic concrete is adjusted so as to commence curing within a short time of being introduced between the preformed layers, whereby lower layers of the plastic concrete cure when further layers of the plastic concrete are introduced.

10. (Amended) A method according to [any of claims 4 to 8] claim 4 wherein the material layers are formed from synthetic resin.

11. (Amended) A method according to [any of claims 4 to 9] claim 4 wherein the core layer comprises a thermosetting resin or a thermoplastic resin.

14. (Amended) A method according to [any of claims 10 to 13] claim 10 wherein the core layer further includes a reinforcement.

17. (Amended) A method according to [any of claims 13 to 15] claim 13 wherein the core layer includes further reinforcement.

Improvements in or Relating to Pipes

This invention is concerned with improvements in or relating to pipes and a method of manufacturing same, particularly but not exclusively to corrosion resistant pipes adapted for use with liquids having high chemical concentrations or of a corrosive nature, or in cases where the liquid in the pipes should not be contaminated, such as a pipe conveying potable water. The invention may also be suitable for use in ground having a corrosive nature.

According to the present invention there is provided a pipe comprising a plurality of material layers, a core layer being formed of a composite material formed by a coalescence of materials, including an aggregate of materials providing strength and rigidity and a bonding agent, (hereinafter referred to as plastic concrete), and outer layers on respective sides of the core layer, each of the outer layers being formed of a plastics material.

The present invention further provides a method of manufacturing a pipe, the method comprising forming a pair of material layers from a plastics material, positioning the material layers in a spaced apart relation, and forming a core layer between the preformed material layers.

The core layer may be formed of plastic concrete and may be introduced in a flowable state between the preformed material layers to be moulded therein. The preformed material layers provide formwork for the moulding. The preformed material layers are moulded and are retained in their moulds to provide the formwork for moulding of the core layer.

The plastic concrete may be adjusted so as to commence curing within a short time of being introduced between the preformed material layers, whereby lower layers of the plastic concrete cure when further layers of the plastic concrete are introduced.

The present invention also provides a mould assembly for moulding a pipe, the assembly comprising a plurality of moulds formed of polymer

concrete.

An embodiment of the present invention will now be described by way of example only, with reference to the accompanying drawing, the single figure of which is a diagrammatic section through a mould assembly for producing a pipe.

A pipe, for use as a sewage pipe, is formed by producing a sandwich construction in the form of two preformed laminates on respective sides of a core material. The laminates may each be formed from a synthetic resin and the core may be a composite material formed from plastic concrete which provides the required stiffness and strength for the structure. The bonding agent is a thermosetting resin, for example polyester, epoxy, acrylic, vinylester, polyurethane or phenolic, or can be a thermoplastic resin, for example polyvinylchloride, polypropylene or polyurethane. The aggregate can be an inorganic material, for example any of silica sand, silica powder, calcium powder, gravel, stone chippings, ceramic powder or ceramic chippings, or any combination thereof. To provide further strength, other types of reinforcement can be included in the plastic concrete, such as glass, metal or plastic fibres. By using a synthetic resin in forming the laminates and the core, the bond between the laminates and the core can be improved and the core becomes more of an integral part of the laminates.

Referring to the drawing, the two preformed laminates are in the form of reinforced plastic pipes or tubes 10, 12, formed by filament winding a pipe, by hand lay up, or by forming a sheet which is then rolled and bonded to form a tube. A mould assembly is provided which comprises a base ring mould 14 and a top ring mould 16. The inner tube 10 locates in the mould assembly to extend between the base ring mould 14 and the top ring mould 16. The outer tube 12 also extends between the moulds 14, 16, locating in respective slots in the ring moulds. A cone 18 locates above the mould 16 and assists in guiding the plastic concrete when it is poured into the annular space between the tubes 10, 12. The cone 18 also centrally locates the inner tube 10. After completion of the casting of the plastic concrete, as hereinafter described, the cone 18 is

removed and a mould 20 is fitted, further plastic concrete then being poured into the gap between the pipe 10 and the mould 20 to form the top spigot of the pipe. All of the moulds 14, 16, 18 and 20 are held together by tie bars.

The moulds 14, 16, 18 and 20 are cast in polymer concrete so as to reduce costs. From one machined mould there can be cast numerous polymer concrete moulds so that the unit cost is lower and the polymer concrete moulds can be produced on site.

By adjusting the thickness and type of materials used in the inner and outer tubes 10, 12, the finished pipe can be designed to have different properties. In pressure pipes, the inner tube 10 can be designed to be strong enough to take all the pressure, the plastic concrete and the outer tube 12 providing stiffness and structural integrity. In pipes used to convey potable water, the inner tube could be made from materials which are non-toxic, such as epoxy, which would not contaminate the water in the pipe.

The ability to adjust the thickness has the advantage that it enables substantially different types of pipe to be produced. For example, the following pipes can be produced: pressure pipes; gravity pipes for carrying potable water, sea water, contaminated water; or pipes for carrying chemicals or acids. Where the pipe is to be buried, the ability to adjust the thickness means that the thickness of the outer layer can be increased to make the pipe able to withstand greater loads without increasing the overall diameter of the pipe. It has also bee found that by slightly adjusting the thickness of the two layers, the pipe strength can be adjusted.

By adjusting the mixture of the plastic concrete, the latter can start to cure within a few minutes of being poured. By also adjusting the volume of plastic concrete being poured and maintaining a constant vibration to ensure that the plastic concrete is consolidated and air pockets are removed, it is possible to cast pipes over 6 metres in length without providing any support to either of the inner or outer tubes 10, 12. Support is not required because the head of liquid plastic concrete changes as the lower layers of the plastic

concrete cure. This also means that the thickness of the inner and outer tubes 10, 12, can be reduced to save costs. When using a pipe as a jacking pipe, the length is not important, being restricted to the size of the shaft and the machine. However when a pipe is used for conventional open trench laying, longer pipe lengths are preferred, reducing the number of joints and speeding up installation. The time to lay any length of pipe is basically the same, and as the weakest point of any pipe is the joint, the more joints there are, the more there are potential problems.

It is also possible for a pigment to be added to one or both of the inner and outer tubes 10, 12. The pipes produced can be colour coded so that, for example, pipes for potable water are coloured blue, pipes for sewage are coloured black, and pipes for effluent are coloured green. In effect, this would enable pipes to be coloured to conform to the international pipe identification standards.

Pipes can be produced by the method described herein to meet the following standards, namely: ASTM D3262 fibreglass (glass-fibre-reinforced-thermosetting-resin) sewer pipes; ASTM D3754 fibreglass (glass-fibre-reinforced-thermosetting-resin) sewer and industrial pipes; ASTM D3517 fibreglass (glass-fibre-reinforced-thermosetting-resin) pressure pipes. These standards were introduced for pipes produced by spinning. However, pipes produced by the above described method have high strength but are produced at reduced cost.

With previous methods of constructing pipes using plastic concrete, a pipe has required to have a large cross-section to be strong enough, thereby increasing the weight of the pipe. Although this does not cause a particular problem when the pipe is to be used as a micro tunnelling pipe, the weight of the pipe is important with conventional open trench applications. In many cases a crane cannot be positioned alongside where the pipe is to be laid and this means that in order to lift the pipe the crane would need to have its jib extended, which reduces its load carrying capabilities. Also with previous methods an inner liner has had to be strong enough to resist buckling loads

caused by the head of the plastic concrete when being poured. This increased cost and the liner cost often became as much as 75% of the cost of the finished pipe. Where a thick liner is used, pipe length is restricted, unless there is provided an internal support shutter which is difficult to manufacture and remove without damaging the inner liner. If a collapsible mandrel is used, this makes the mould cost prohibitive, and it is difficult to make a collapsible mandrel over 3 metres.

Further, if the plastic concrete was to be completed in stages, problems arise in achieving a suitable bond between the layers of plastic concrete. As the latter would be poured from the top, it would adhere to the liners and cure, so restricting the flow when the next batch of plastic concrete is poured. Also air pockets would be caused in the plastic concrete as the uncured plastic concrete would form around the previously cured material.

In addition, previous pipe mould assemblies have used metal shutters which are expensive to manufacture and are restricted in length, making it necessary to join segments together. Such joints make the overall shutter very heavy and often difficult to produce. An outer abrasive resistance surface for the pipe has to be applied to the inner face of the shutter by hand, which takes time, and the lining has to cure before the shutter mould can be assembled to the other moulds. Due to the weight of the shutter and its height, an overhead crane is required and it takes time to assembly and disassemble the shutter. Also previously, ring moulds have been machined out of steel and were therefore expensive and heavy, increasing cost.

A pipe which is manufactured as hereinbefore described, using the mould assembly of the drawing, can be easily produced on site and meets the following requirements:- lightweight but strong; low cost; corrosion resistant; easy to install; and available in large volumes. Large pipe projects stretch for many miles and transportation of pipe can be a big cost, particularly if the pipes have to be imported. To produce a pipe as hereinbefore described requires very little capital investment and no major infrastructure, only a covered area with a flat concrete floor. On completion, equipment can be removed to another site.

Various modifications may be made without departing from the invention.

Claims

1. A pipe comprising a core layer being formed of a composite material formed by a coalescence of materials, including an aggregate of materials providing strength and rigidity and a bonding agent, and outer layers on respective sides of the core layer, each of the outer layers being formed of a plastics material.

2. A pipe according to claim 1 wherein the core layer is formed of a plastic concrete.

3. A pipe according claim 1 or 2 where the outer layers are in the form of tubes.

4. A method of manufacturing a pipe comprising forming a pair of material layers from a plastics material, positioning the material layers in a spaced apart relation, and forming a core layer between the preformed material layers.

5. A method according to claim 4 wherein the material layers are in the form of tubes.

6. A method according to claim 4 or 5, wherein the core layer is formed of a plastic concrete and is introduced in a flowable state between the preformed material layers to be moulded therein.

7. A method according to any of claims 4, 5 or 6, wherein the preformed material layers are formed and are retained in their moulds to provided the formwork for moulding of the core layer.

8. A method according to claim 7 wherein the preformed layers are formed by filament winding, by hand lay up, or by forming a sheet which is then rolled and bonded to form a tube.

9. A method according to any of claims 4 to 8 wherein the plastic concrete

is adjusted so as to commence curing within a short time of being introduced between the preformed layers, whereby lower layers of the plastic concrete cure when further layers of the plastic concrete are introduced.

10. A method according to any of claims 4 to 8 wherein the material layers are formed from synthetic resin.

11. A method according to any of claims 4 to 9 wherein the core layer comprises a thermosetting resin or a thermoplastic resin.

12. A method according to claim 10 wherein the thermosetting resin is one or more of a polyester resin, an epoxy resin, an acrylic resin, a vinylester resin and a polyurethane resin.

13. A method according to claim 10 wherein the thermoplastic resin is one or more of a polyvinylchloride resin, a polypropylene resin and a polyurethane resin.

14. A method according to any of claims 10 to 13 wherein the core layer further includes a reinforcement.

15. A method according to claim 13 wherein the reinforcement is an inorganic material.

16. A method according to claim 15 wherein the inorganic material is one or more of silica sand, silica powder, calcium powder, gravel, stone chippings, ceramic power and ceramic chippings.

17. A method according to any of claims 13 to 15 wherein the core layer includes further reinforcement.

18. A method according to claim 16 wherein the further reinforcement includes one or more of glass, metal and plastic fibres.

19. A method of manufacturing a pipe, the method comprising forming a pair of inner and outer tubular laminates from a plastics material, locating the respective ends of the inner and outer laminate in respective first and second moulding members, arranging a third moulding member on the first and second layers, to guide the plastics material into the space between the first and second layers, introducing a moulding material between the first and second layers via the third moulding member, the moulding material being formed of a plastic concrete, removing the third moulding member, and providing a fourth moulding member on the third moulding member, and introducing further plastic concrete into the gap between the inner tube and the fourth moulding member.

20. A mould assembly for moulding a pipe, the assembly comprising a plurality of moulds formed of polymer concrete.

21. Any novel subject matter or combination including novel subject matter disclosed herein, whether or not within the scope of or relating to the same invention as any of the preceding claims.

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

CORRECTED VERSION

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(71) Applicant and
(72) Inventor: BOATMAN, Peter, James [GB/GB]; 4 Hardings Cottages, St. Thomas, Exeter EX4 1HD (GB).

(74) Agent: LOCK, Howard, John; Swindell & Pearson, 48 Friar Gate, Derby DE1 1GY (GB).

(81) Designated States *(national)*: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

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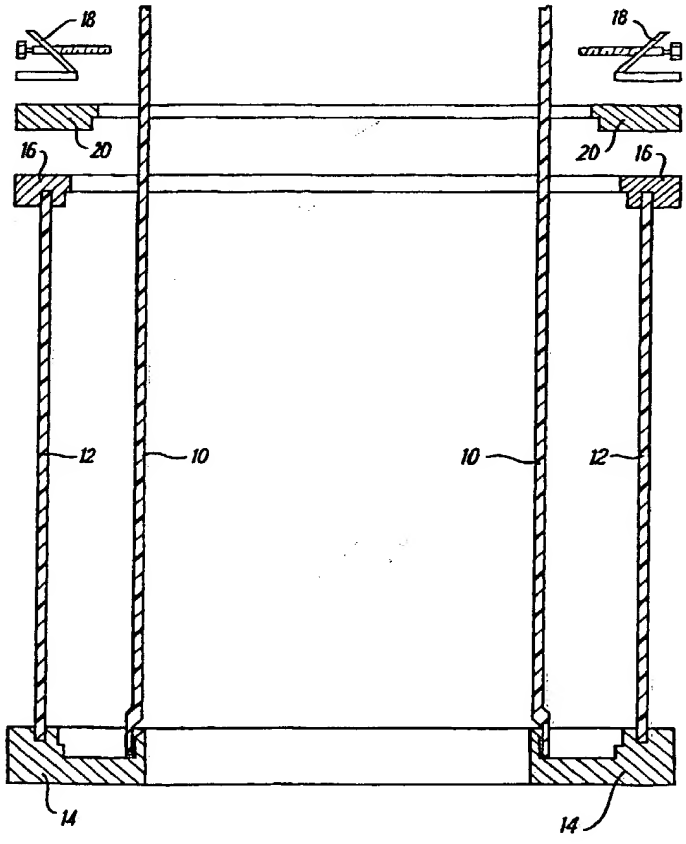
[Continued on next page]

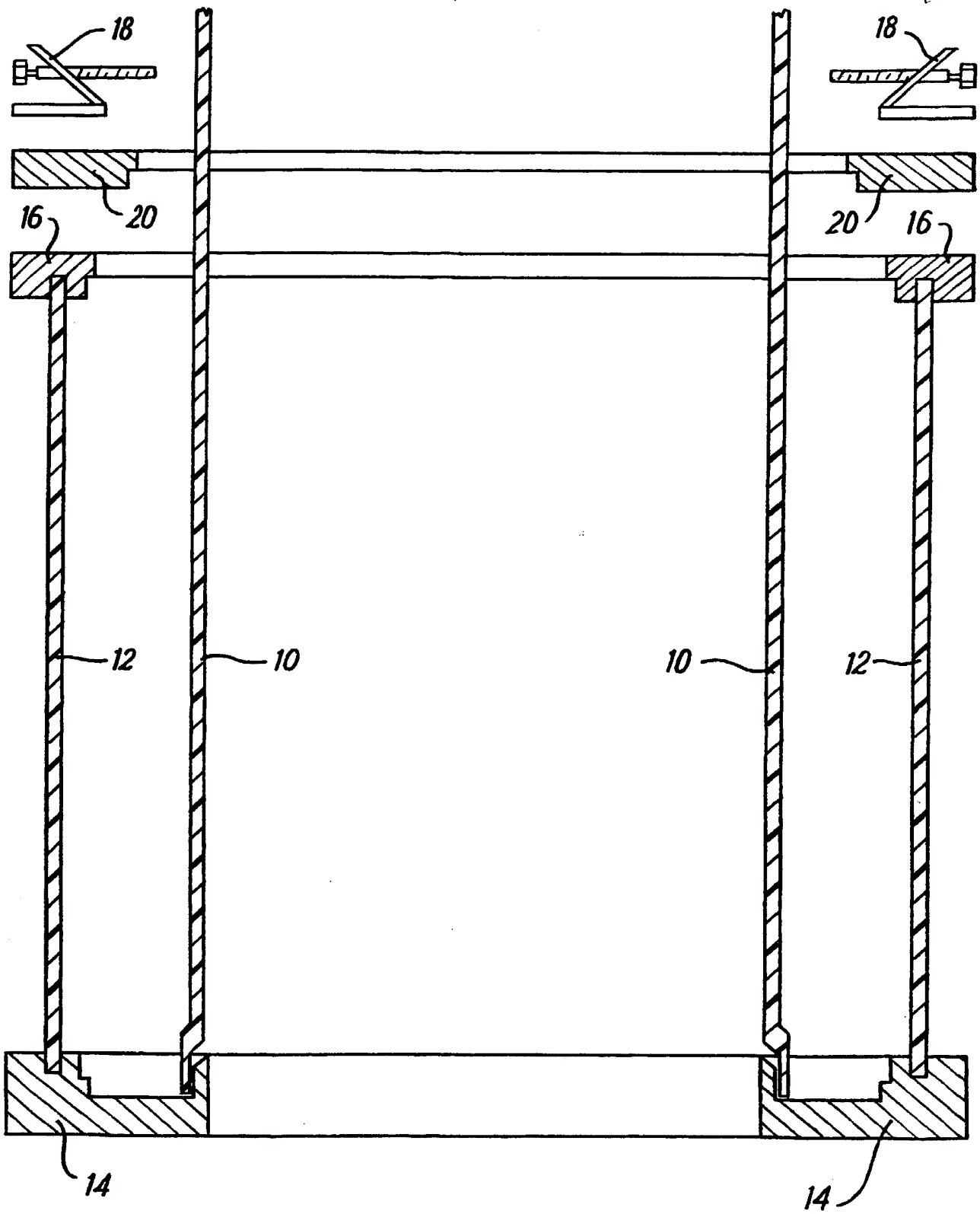
(54) Title: IMPROVEMENTS IN OR RELATING TO PIPES



(57) Abstract: A method of manufacturing a pipe, comprises forming a pair of material layers (10, 12) from a plastics material. The material layers (10, 12) are positioned in a spaced apart relation. A core layer is formed between the preformed material layers. The layers are tubular in configuration. A pipe formed from the layers is also disclosed.

WO 00/35664 A1

Fig 1



Declaration (37 CFR §1.63) for Utility or Design Application Using an Application Data Sheet (37 CFR §1.76) and Power of Attorney for Patent Application

As a below named inventor, I hereby declare that:

This declaration is directed to: IMPROVEMENTS IN OR RELATING TO PIPES

[ ] The attached application, or

[XX] Application No. 09/857,852, filed on June 11, 2001

and was amended on June 11, 2001 (if applicable);

I believe that I am the original and first inventor of the subject matter which is claimed and for which a patent is sought;

I hereby state that I have reviewed and understand the contents of the above identified application, including the claims, as amended by any amendment referred to above;

I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56.

If this application is a continuation-in-part application, I acknowledge the duty to disclose to the Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56, which became available between the filing date of the prior application and the national or PCT international filing date of this continuation-in-part application.

I hereby declare that all statements made hereby of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agents(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith: W. THAD ADAMS, III, REG. NO. 29,037; JEFFREY J. SCHWARTZ, REG. NO. 37,532; T. PEIGE WISE, REG. NO. 44,407 and STEPHEN S. ASHLEY, JR., REG. NO. 47,394, addressed to:

ADAMS, SCHWARTZ & EVANS, P.A.
2180 Two First Union Center
301 S. Tryon Street
Charlotte, North Carolina 28282
Telephone: 704-375-9249
Facsimile: 704-375-0729

I request that all correspondence, telephone calls and/or facsimiles be directed to W. Thad Adams, III, Jeffrey J. Schwartz, T. Peige Wise or Stephen S. Ashley, Jr. at their above-stated address.

FULL NAME OF INVENTOR(S):

Inventor one: Peter James Beatman — Citizen of: United Kingdom

Signature: _____ — Date: 27th July 2001

Inventor two: _____ — Citizen of: _____

Signature: _____ — Date: _____

Inventor three: _____ — Citizen of: _____

Signature: _____ — Date: _____

United States Patent & Trademark Office

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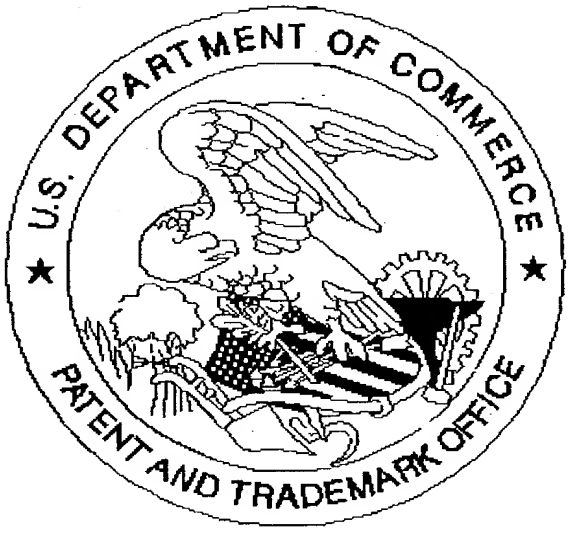

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